letters

lead to a reduced budget for NSF. Should this happen, then a number of the creative and socially aware scientists who feel that the only—albeit little—effect they have in their professional lives to counteract the continuing self-destructive, militaristic trend in the world by not working on any project administered by a military agency will be squeezed out of areas of basic science to its detriment.

I therefore recommend that more vigorous and stronger basic-science programs be adopted and administered by NSF, NIH, NASA and similar civilian agencies.

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10/30/78

Pauli remembered

Laurie Brown's article "The Idea of the Neutrino" in September (page 23), I found both informative and delightful.

It was my privilege to have been a postdoctoral student of Wolfgang Pauli in Zurich during the years 1953–55. There I learned at first hand the truth of a remark R. A. Millikan made in a course he gave at Caltech on the history of physics: "Physicists are more interesting than Physics."

In the fall of 1953, just before the Christmas recess, word came through that Fred Reines and Clyde Cowan (Phys. Rev. **92,** 830, 1953) had successfully detected the free neutrino in experiments at Los Alamos. This provided conclusive proof of Pauli's idea of the neutrino—an idea that underwent significant evolutionary developments (as discussed by Brown) from the time of Pauli's original suggestion in December 1930 to the parity nonconservation experiments in 1957.

To celebrate, a number of us from ETH and the University of Zurich climbed the Utilberg near Zurich, where we had dinner. On the way down, Bleuler and I noticed that Pauli was a little wobbly from the red wine we had at dinner. (He had graciously responded to many individual toasts.) Bleuler said to me: "Take his left arm—I'll take his right arm, we can't afford to lose him now." Later when we were about midway, Pauli turned to me with a comment I shall always treasure, "Remember, Barker," he said, "all good things come to the man who is patient."

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11/17/78

Non-university research

The report of the NSF Subcommittee on Job-Related Issues, described in August (page 69) raises issues that deserve wider discussion.

The Subcommittee concluded the US should create at least 400–500 jobs in physics, and it recommended the creation of two categories of temporary jobs within university physics departments. It is obvious that the large departments would benefit greatly, but it is not so obvious that the recipients of the proposed jobs would benefit in equal measure. Many might prefer real jobs to 5–10 years of a not-quite-faculty limbo; if they are the outstanding people the Subcommittee would have them be, perhaps they deserve better.

If the Subcommittee's objective was revivication of basic research, why did it not give more attention to industry, the civil service and the national laboratories? The Subcommittee, in concluding that firm data are lacking to substantiate the claim that the employment situation in national laboratories is as bad as in the universities, behaved as if existing data *disprove* the claim. Moreover, the PHYSICS TODAY report does not indicate that the Subcommittee interested itself in the available documentation concerning the erosion of basic research in industry and the civil service.

Recently a number of articles have appeared claiming to voice concern about the state of basic research in the US (examples are cited at the end of this letter[1]). In fact the articles were concerned primarily about basic research in the universities, and in some cases they virtually made one-to-one identification between the two. One might have wondered whether basic research was being used merely as a vehicle for special pleading on behalf of academic science. The NSF Subcommittee's seeming indifference to the welfare of basic research outside the academy is another example of this selective concern.

Though most US basic research is performed in universities (plus national laboratories), even a glance at the list of Nobel Prize winners shows that very important basic research also has been performed in both the civil service and industry. It is a perversion of history to talk of "traditional opportunities" in basic science, as the Subcommittee does, and refer only to universities and national laboratories. Since repeated assertion of a proposition often convinces people of its truth, might such talk contribute to *alteration* of traditional patterns in basic research?

Even in the consideration of such a narrow issue as replacing the large number of faculty who will retire in 10–15 years, a broader view of research might have aided the Subcommittee. Many current faculty members first worked in industry, the civil service, or the national laboratories—and in jobs that, unlike the ones proposed by the Subcommittee, were "permanent." Future faculty could be drawn from such nonacademic institutions—and in great quantity if such or-

ganizations give support to basic research.

One might even argue that the universities would benefit more in the long run from the creation of extra-academic basic research jobs than from the Subcommittee's proposal: faculty drawn from outside academia would bring in new perspectives and could provide bridges to industry and government that are sorely lacking.

The scientific community has recently encouraged discussion of the amount of basic research the US should support. Scientific societies such as The American Physical Society and the American Chemical Society have sponsored studies on technical facts of some important public issues. Yet on other matters, for example the structure of basic research performance in the US, there is a near-uniformity of published views that is more consistent with revealed "truth" than with vigorous debate and inquiry. We still have far to go in ensuring that science policy is discussed openly and thoroughly, and in ensuring that the discussion encompass individuals who have disparate viewpoints and interests.

Reference

1. P. H. Abelson, Science **200,** 1111 (1978); D. DeSolla Price, in "Oversight of Science and Technology Policy," Joint Hearing before the Senate Subcommittee on Science, Technology, and Space and the House Subcommittee on Science, Research, and Technology, 14 February 1978, Serial No. 95-77, GPO, 1978; R. Roy, Chem. & Eng. News, 10 January 1977, page 4; J. Sawhill, Chem. & Eng. News, 24 July 1978, page 5; J. B. Wiesner, Boston Globe, 20 February 1978.

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9/12/78

THE CHAIRMAN REPLIES: Several comments in Michael Alexander's letter require clarification and comment. The proposed National Research Physicist appointment, endorsed unanimously by the NSF Advisory Committee for Physics, is *not* restricted to university physics departments. The guidelines recommended by the subcommittee state: "the host institution may be any university, national laboratory or non-profit institution acceptable to the selection panel."

The full report of the Subcommittee on Job Related Issues is available from the Physics Division of the National Science Foundation. Inspection of this document should dispel the erroneous notion that the subcommittee was exclusively concerned with the research vitality of universities. Nevertheless no apology need be made for the emphasis on university research: (1) the university community is the largest single source of first-rate basic physics research; (2) extensive documentation is available on university faculty composition; (3) this community is the one most directly affected by the actions of the NSF.

Comparable documentation does not exist on basic science in national laboratories. As head of a large research organization in a national laboratory I am keenly aware of the harmful trends of the past decade. But national programs cannot be justified on the basis of anecdotal information. Not mentioned in the PHYSICS TODAY report is the followup activity of the subcommittee in discussions with DOE officials about actions to improve opportunities for young physicists in the national laboratories.

Further recommendations of the subcommittee pertaining to the non-academic community follow:

▸ **Applied Science Workshops.** We propose that the NSF fund workshops on topics of scientific and technological concern to national and industrial laboratories.

▸ **Industry-University Cooperation Programs.** We propose the creation of Career Development Grants for the temporary support of young investigators (say, less than 35 years of age) in proposals involving the cooperative research of a university and an industrial laboratory.

▸ **Employment Data Bank.** We recommend that more complete and detailed employment data be kept on physics and its subfields, in order that appropriate actions can be motivated and executed.

▸ **Career Development Grants at National Laboratories.** Such awards could provide a mechanism for talented PhD's trained in pure scientific research to become effective in applied science. The subcommittee felt that the initiative for such a program should originate in the responsible agencies (DOE, DOD, NASA and so on).

▸ **Summer-Job Program for Students.** An expanded summer-job program for physics students would increase the entry into applied-science positions in national laboratories and industry.

Further details of these proposals will be found in the full report of the subcommittee.

The subcommittee is guilty of not devoting much time to basic research in the civil service. I will appreciate receiving any available information about the "available documentation" in this area to correct this oversight.

It is hoped that the foregoing explanations make it unnecessary to respond to the polemical passages in Alexander's letter.

The brief report of the subcommittee's activities in PHYSICS TODAY did not include the names of the participating members. These are: Ronald Geballe, June Matthews, Fay Ajzenberg-Selove,

letters

Jeremiah Sullivan, Chia-Wei Woo and Laura P. Bautz.

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NSF Advisory Committee for Physics
11/27/78 (Los Alamos Scientific Laboratory)

Vocations vs. avocations

I read with interest the letters regarding employment in November. If I may, I would like to present another view of the employment issue. My comments are not directed at those who entered physics just to become physicists, but at those who study physics because of an insatiable desire to disrobe nature and marvel at her charms on the most fundamental level attainable.

The point I would like to make is best illustrated by an example: my own. I have had experience in both experimental and theoretical physics as evidenced by a few of my publications.[1–4] Of these papers, three were a matter of survival, whereas the fourth[4] was an act of love. I was paid only for the first three; the fourth was based on my dissertation (University of Houston, 1977) and was only indirectly supported by a teaching fellowship. Herein lies the essence of the employment problem.

Many of us would like to work on pet projects of our own choosing. However, society is unwilling and unable to support most of these efforts. Consequently the majority of physicists, especially in my generation, must seek means of financial support in areas very often remotely related to our professional interests. These are the facts of life and they are unlikely to improve in the foreseeable future. Grim, isn't it?

No!

There are many professions open to physicists at all levels (BS, MS, PhD) today because of our broad training in the physical sciences. Furthermore, many of these professions pay far better than post-docs or assistant professorships.

Ah, you say, you're listening to a mercenary. Not so, and here's why.

If you'll browse through the want ads at the back of this magazine you'll see virtually every available position is for only one to two years and is to be filled by an individual to do a particular chore. If this chore is your cup of tea and you get the job, great! Usually, however, the chore is just that: a chore. Can you do better than this?

I think you can. When I entered physics I hoped to develop a theory of nature as I understood it. I'm sure many of my colleagues had a similar motive for embarking on the difficult, albeit gratifying, study of physics. I considered myself fortunate that I was able to develop such a theory for my PhD dissertation; however, this permission was granted only after I demonstrated my competence as a scientist by doing work others wanted done. This is as it should be. Unfortunately there are no funded positions for the work I'm interested in, so I turned to industry for my livelihood. The big advantage I now have by working in industry is that I can generate my own resources to achieve my objectives, including publishing a novel.[5] I have the freedom to select what topics I want to work on as my avocation while my vocation pays for it.

Need I remind you of Albert Einstein's tenure in a patent office? The opportunities available to him then are there for us now, as my case illustrates. Those of you who do not find a job in a government laboratory or academia shouldn't despair. Don't be afraid to go out in industry and make your mark, and while you're at it, do some physics of your own choosing. We may have another Einstein waiting in the wings!

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5. J. R. Fanchi, K. F. Fanchi, *The Alternative*, Decameron Pub., P.O. Box 19734, Houston (1979).

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Engineering physics

In the last year there have been a number of articles and statements regarding job opportunities for physicists and about new programs designed to give young physicists an applications orientation. An option not discussed has been in effect at the University of Virginia since the early 1950's. This option requires neither new courses nor additional faculty course loading, but rather an enlightened cooperation between the already existing applications-oriented programs (that is, the engineering programs) and a physics department.

The Engineering Physics program has been producing students in applied physics who have taken roughly half of their courses in engineering and half in physics leading to Masters of Engineering, Masters of Science and PhD degrees. The job opportunities have been excellent, particularly in the classical-physics oriented fields (fluids, mechanics and gas dynamics) as well as in the solid-state

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